

**U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON TECHNOLOGY AND INNOVATION**

HEARING CHARTER

*The National Windstorm Impact Reduction Program: Strengthening Windstorm
Hazard Mitigation*

Thursday, July 24, 2008

10:00 a.m. – 12:00 p.m.

2318 Rayburn House Office Building

1. Purpose

The purpose of this hearing is to review the activities of the National Windstorm Impact Reduction Program (NWIRP) and to examine the role of R&D in saving lives and reducing property losses from windstorms. The witnesses will also discuss advancements in wind hazard mitigation and methods of transferring the results of research into practice for code developers, builders, and property owners. Lastly, the witnesses will provide testimony on the priorities for a reauthorization of NWIRP, which expires in fiscal year 2008, and any changes needed to increase the effectiveness of the program.

2. Witnesses

- **Dr. Sharon Hays** is the Associate Director of the White House Office of Science and Technology Policy (OSTP);
- **Dr. Marc Levitan** is the Director of the Hurricane Center at Louisiana State University (LSU) and an Associate Professor in the LSU Department of Civil and Environmental Engineering;
- **Ms. Leslie Chapman-Henderson** is the President and CEO of the Federal Alliance for Safe Home, Inc. (FLASH)
- **Dr. Timothy Reinhold** is the Senior Vice President for Research and Chief Engineer at the Institute for Business & Home Safety (IBHS).

3. Brief Overview

- Hurricanes, tornadoes, thunderstorms, and other severe wind-related weather can claim lives, cause injuries, and cause billions of dollars in damages. In 2007, according to the National Weather Service, 111 Americans died in tornadoes and thunderstorm winds, and this year, tornadoes have already killed 119 people. The economic impact of the 2004 and 2005 hurricane season alone totaled over \$160 billion. As more people move to vulnerable coastal areas, these losses are expected to increase.
- The National Windstorm Impact Reduction Program (NWIRP) is a federal program which includes the National Science Foundation (NSF), the National Oceanic and Atmospheric Administration (NOAA), the National Institute of Standards and Technology (NIST), and the Federal Emergency Management Association (FEMA).

The objective of NWIRP is to decrease the loss of life and property from windstorms through research and development on weather phenomena and mitigation techniques. Created in 2004, the program has received little attention from the Administration. Expenditures for R&D related to NWIRP, as reported by the Administration were approximately \$7.5 million in total since FY2004¹. This amount is well below authorized levels. The participating agencies have also failed to coordinate the ongoing wind hazard related R&D through other mechanisms.

- Reports from the National Research Council (1999) and RAND (2003) argue that a well funded, coordinated R&D framework could reduce wind losses. The RAND report, commissioned by OSTP, analyzed federal disaster-related R&D funding and found that the majority of this money supported short-term weather prediction. The report recommended that the balance in funding shift toward R&D for long-term mitigation measures. Despite this recommendation, the federal R&D portfolio has not been rebalanced to adequately fund research on windstorm impacts and mitigation measures.
- Mitigation efforts can reduce losses to wind-related disasters significantly, but these measures are not widely adopted in hazard prone areas. Barriers to adoption include high capital cost, the lack of financial incentives, and a lack of knowledge by property owners.

4. Background

High winds in hurricanes, tornados, thunderstorms, and other weather phenomena cause significant damage to buildings and infrastructure. Annually, such weather is also responsible for an average of 124 American fatalities² and over 1600 injuries. Though better building practices have resulted in fewer fatalities in recent decades (Table 1) total direct property losses in the U.S. from 1996 to 2006 are over \$160 billion (in 2006 dollars). Moreover, costs associated with wind-related natural disasters have doubled or tripled each decade over the past 35 years. Much of the precipitous increase in property losses is due to the rise of population in vulnerable coastal areas. Between 1980 and 2003, the number of Americans living in coastal counties increased by 28 percent. More than 50 percent of Americans now live on the coast and this upward trend is projected to continue³. Those dwelling in manufactured housing (i.e. mobile homes) are at an increased risk of death, injury, and property loss from high-wind storms.

Table 1. Fatalities, injuries, and property losses. Data compiled by the National Weather Service (available at: <http://www.nws.noaa.gov/om/hazstats.shtml>). Property losses reported in millions of USD.

YEAR	Tornado	Thunderstorm	Tropical	Tornado	Thunderstorm	Tropical	Tornado	Thunderstorm	Tropical
------	---------	--------------	----------	---------	--------------	----------	---------	--------------	----------

¹ This figure does not include expenditures by the National Science Foundation (NSF). Spending levels from NSF on NWIRP related activities are unavailable.

² Average calculated from National Weather Service fatality data for 1996 through 2006, exclusive of 2005 hurricane season deaths.

³ 2003 RAND Report: *Assessing Federal Research and Development for Hazard Loss Reduction*, Charles Meade, Megan Abbott.

	Fatalities	and High Wind Fatalities	Cyclone Fatalities	Injuries	and High Wind Injuries	Cyclone Injuries	Property Losses	and High Wind Property Losses	Cyclones property Losses
2006	67	40	0	990	382	1	752.3	603.6	1569.4
2005	38	23	1016	537	228	130	421.8	457.2	93064.4
2004	35	42	34	396	312	840	537.1	3480.1	18901.8
2003	54	43	14	1087	382	233	1265.6	522	1879.5
2002	55	45	51	968	416	346	801.3	372.7	1104.4
2001	40	31	24	743	439	7	630.1	381.6	5187.8
2000	41	51	0	882	458	1	423.6	245.2	8.1
1999	94	62	19	1842	473	10	1989.9	400.2	4190.1
1998	130	65	9	1868	955	77	1714.2	1499.4	3546.6
1997	67	75	1	1033	551	32	730.7	241.8	667.6
1996	25	54	37	705	448	22	719.6	526.5	1436.1

In 2004, Congress passed the National Windstorm Impact Reduction Act (PL 108-360) which established NWIRP. The objective of the program, as stated in the enacting legislation, is “the achievement of major measurable reductions in losses of life and property from windstorms” through a coordinated Federal effort. The Act directs NOAA, NIST, NSF, and FEMA to support activities to improve the understanding of windstorms and their impacts, and to develop and encourage the implementation of cost-effective mitigation measures to reduce these impacts. The statute charges an interagency working group (IWG)--chaired on a rotating basis by FEMA, NSF, NOAA, or NIST--to coordinate the R&D priorities, portfolio, and budget. The program is authorized through FY 2008 (Table 2).

Table 2. Funding Authorized for NWIRP

Agency	FY 2006	FY 2007	FY 2008
FEMA	8.7	9.4	9.4
NSF	8.7	9.4	9.4
NIST	3.0	4.0	4.0
NOAA	2.1	2.2	2.2
Total	22.5	25.0	25.0

As required by legislation, OSTP submitted an NWIRP implementation plan to Congress in April 2006. The plan assessed programs relevant to the goals of NWIRP across eight federal agencies and identified important areas of research that were not covered by current activities. The knowledge gaps covered the three broad categories of research authorized in the Act: understanding windstorms; assessing the impacts of windstorms; and mitigating the effects of windstorms. To further the understanding of windstorms, the plan identifies the need for research on the structure of windstorms and wind behavior, instrumentation for the study of windstorms, and the development of standards for deploying instruments, assessing measurements, and storing and sharing data. Research into assessing the impacts of windstorm would include the response of structures to windstorms and their resilience over time, and social science research on the impact of windstorm damage on communities, particularly vulnerable populations. For mitigation, research is needed to improve building codes and standards, and to develop better decision making tools for all level of government.

The implementation plan also recommends that an IWG within the National Science and Technology Council’s (NSTC) Committee on Environment, Natural Resources Subcommittee on Disaster Reduction oversee the research portfolio outlined above, with representatives from NSF, NIST, NOAA, and FEMA, as well as NASA, the Federal Highways Administration (FHWA), and the Army Corps of Engineers. These agencies support mission-

related R&D on windstorms and windstorm impacts. The IWG would be responsible for facilitating communication between the agencies on the best means of allocating agency resources to meet NWIRP goals and for coordinating this federal research portfolio.

As of the FY2009 budget request, the Administration has never requested funding for NWIRP. Although the implementation plan recommended an IWG coordinate a research portfolio targeted to the identified research needs, there has been little effort to do this. Currently the IWG is not chaired by any agency, as required by statute, nor has OSTP convened an external advisory committee to provide guidance and feedback for the program.

Program activities related specifically to wind-hazard reduction are not explicitly stated in agency budgets, however, the Administration reports that agencies have funded approximately \$7.5 million (not including NSF) in related activities since FY2004. These efforts are summarized below:

- **NSF's** role in NWIRP is to support basic research on engineering and the atmospheric sciences to improve the understanding of windstorms and their impacts on the built environment and lifelines. To that end, NSF has funded research in the atmospheric dynamics that form storms and hazardous winds; post-Hurricane Katrina grants to document and preserve data on the built environment, perform social science research, and to fund engineering studies; and research to gain a better understanding of evacuations and community rebuilding. Estimates from NSF on the total spending related to NWIRP are unavailable, but the agency estimates they will spend \$6.8 million on research related to NWIRP in FY2008.
- **NOAA's** role in NWIRP is to support atmospheric sciences research to improve the understanding of windstorms and their impact on the built environment and lifelines. Aligned with NWIRP's goals, NOAA performs education and outreach related to hazards through Sea Grant institutions and other means; supports research and operations at the National Weather Center for improved prediction and monitoring of severe storms and hazardous winds; gathers field data on hurricane dynamics; develops probes and other monitoring equipment for data collection in extreme weather; develops decision support tools that map wind-speeds; provides information and planning assistance to increase community storm resiliency; and participates on the U.S.-Japan Panel on Wind and Seismic Effects. **NOAA reports spending of \$3.5 million on NWIRP related activities for the period of FY2004 to FY2008.** The NOAA FY2009 budget request includes \$1 million for these activities.
- **NIST's** role in NWIRP is to support R&D to improve building codes, standards, and practices for design and construction of the built environment and lifelines. Activities that NIST has engaged in related to NWIRP include the development of software and procedures to facilitate the use of automated wind impact sensors on buildings; computational tools for determining realistic wind loads on the built environment; methodologies for predicting ultimate structural capacities; post-Hurricane Katrina evaluations of the built environment; providing technical information to improve codes and standards; and participating on the U.S.-Japan Panel on Wind and Seismic Effects. **NIST reports spending of \$2.45 million on NWIRP related activities for the period of FY2004 to FY2008.** The NIST FY2009 budget request includes \$1.4 million for these activities.

- **FEMA's** role in NWIRP is to support the development of risk assessment tools and the effective mitigation techniques, windstorm related data collection and analysis, and conduct public outreach and information dissemination to promote mitigation measures. Activities identified by FEMA that meet these goals include: update and development of HAZUS, a modeling tool for communities to estimate damage, economic loss, and social impacts of storms; Mitigation Assessment Teams (MAT) studies of building performance after major storms; construction guidance for building in vulnerable coastal areas and storm shelters; and cooperation with NOAA to improve evacuation planning for hurricanes. **FEMA reports spending of \$1.5 million on NWIRP related activities for the period of FY2004 to FY2008.** FEMA estimates spending on these activities for FY2009 to between \$200,000 and \$250,000.

In 2003, the RAND Corporation released a report commissioned by OSTP to assess federal spending on disaster-related R&D. The study found that the majority of such funding goes to fundamental research into atmospheric and meteorological aspects of windstorms and other weather. A significantly smaller portion went toward structural engineering R&D on buildings and other infrastructure to increase their resilience during and after windstorms. The RAND report recommended that the R&D focus shift toward long-term mitigation efforts. The report stated, “This is especially relevant for weather related hazards, for which R&D is primarily limited to procurements for short-term forecasting efforts,” noting that short-term prediction efforts can have a life-safety impact but generally do not reduce property or economic losses. A 1999 National Research Council report⁴ recommended that: “the federal government should coordinate existing federal activities and develop, in conjunction with state and local governments, private industry, the research community, and other interested stakeholder groups, a national wind-hazard reduction program. Congress should consider designating sufficient funds to establish and support a national program of this nature.” Experts in mitigation argue that support for windstorm hazard mitigation could result in similar benefits to those generated by the National Earthquake Hazard Reduction Program (NEHRP). This program, created by Congress in 1978, is a coordinated interagency effort to reduce the impact of earthquakes on the built environment and communities. Researchers in both fields (wind and earthquake engineering) often point to the minor damage from the 2001 6.8 Seattle earthquake as evidence that thirty years of funding earthquake engineering R&D have had measurable results⁵.

Measures to mitigate damage from windstorms are currently available, but they are not universally adopted. A study published in 2008 by the Wharton Risk Management and Decision Process Center at the Wharton School of Business quantified the impact of mitigation, showing that mitigation efforts could reduce hurricane-related losses by 40 to 60 percent. Similarly, post-storm FEMA MAT reports consistently show that houses built to modern codes generally remain standing through a storm, compared to those not built to code. A natural tendency to ignore or downplay the risk of catastrophe could explain the lack of

⁴ 1999 National Research Council Report: *Review of the Need for a Large-Scale Test Facility for Research on the Effects of Extreme Wind on Structures.*

⁵ 2003 RAND Report: *Assessing Federal Research and Development for Hazard Loss Reduction*, Charles Meade, Megan Abbott.

adoption of mitigation measures however, other barriers, such as the high cost of implementation and limited financial incentive (through reduction in insurance premium, tax incentives, etc), and a lack of understanding of risk and available mitigation technologies also prevent more wide spread use of mitigation measures.

5. Issues and Concerns

- The costs associated with windstorms are rising, but little funding has gone toward understanding windstorms and their impacts and developing mitigation measures. Reports from the National Academies, RAND, and OSTP's NWIRP Implementation Plan strongly recommend a coordinated effort for R&D to reduce hazards from windstorms. The limited research that NSF, NIST, NOAA, and FEMA have supported is not well coordinated. For example, although NIST, FEMA, NSF, and several other federal agencies dispatched resources to examine the effects of Hurricanes Katrina and Rita, there is little evidence that these activities were coordinated.
- As stated in the 2003 RAND report, to achieve a reduction in the massive economic losses from windstorms, the federal R&D portfolio should support long-term research on hazard reduction methods. Based on the funding levels for NWIRP reported by the Administration, this type of research is not adequately supported at the federal level. Researchers in the wind engineering community point to a consistent lack of funding as a cause in the decline in the number of graduate students and professors in the wind engineering profession and as a hindrance to advancing knowledge that would have useful applications in reducing losses from windstorms.
- Mitigation techniques do exist to save lives and reduce damages but they are not universally adopted. Decreasing the cost of mitigation measures and increasing the education and outreach to property owners could increase the adoption of mitigation techniques.
- The authorization for NWRIP expires this fiscal year (FY2008). To date, the program has not been well implemented. Changes to the legislation and the program should be considered if the reauthorized NWIRP is to be an effective program.